MATH 120 Section 7.2 Sets

Definitions: A set is any collection of objects. Each object in a set is called a member or element of the set. A set without any elements is called the empty or null set. A finite set is a set that has a finite number of elements. An infinite set is a set with an infinite number of elements.

Rule Method vs Listing Method for Sets

Example: 1) Complete the table.

<table>
<thead>
<tr>
<th>Rule Method</th>
<th>Listing Method</th>
<th>Finite or Infinite?</th>
</tr>
</thead>
<tbody>
<tr>
<td>{x</td>
<td>x is a weekend day}</td>
<td>{Saturday, Sunday}</td>
</tr>
<tr>
<td>{x</td>
<td>x^2 = 4}</td>
<td></td>
</tr>
<tr>
<td>{x</td>
<td>x is an odd counting number}</td>
<td></td>
</tr>
</tbody>
</table>

*Read: “The set of x such that x is a weekend day.”

Symbols & Notation

\(\in\) is an element of

\(A \subset B\) : Set A is a subset of set B means every element of A is an element of B.

\(A = B\) : Set A is equal to set B if every element of A is an element of B AND every element of B is an element of A, that is, \(A \subset B\) AND \(B \subset A\).

\(\emptyset = \{\\}\) is the empty set. Note: The empty set is a subset of every set.

Examples: Let \(A = \{-3, -1, 1, 3\}, B = \{3, -3, 1, -1\}, C = \{-3, -2, -1, 0, 1, 2, 3\}\). Determine if the following are true or false.

2) 3 \(\in\) A  
3) 0 \(\in\) A  
4) A \(\subset\) B  
5) B \(\subset\) A  
6) A = B  
7) A \(\subset\) C  
8) C \(\subset\) A  
9) A \(\neq\) C  
10) \(\emptyset\) \(\subset\) A  
11) \(\emptyset\) \(\subset\) C  
12) \(\emptyset\) \(\in\) A
Example: 13) List all subsets of the set \{a, b, c\}.

Universal Set, Intersection & Union

U: The universal set is the set of all elements under consideration.

\( A \cap B = \{x | x \in A \text{ and } x \in B\} \): A intersection B is a set of all elements in A AND B.

\( A \cup B = \{x | x \in A \text{ or } x \in B\} \): A union B is a set of all elements in A OR B (or both).

\( A' = \{x \notin A\} \): The complement of A is the set of elements in the universal set that are not in A.

Examples: Let \( U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} \), \( A = \{3, 6, 9\} \) and \( B = \{3, 4, 5, 6, 7\} \). Determine the following sets. Write using the listing method.

14) \( A \cap B \)

15) \( A \cup B \)

16) \( A' \)

17) \( B' \)
Examples: Let \( U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} \), \( A = \{3, 6, 9\} \) and \( B = \{3, 4, 5, 6, 7\} \). Draw a Venn diagram and then answer the following:

18) \( A \cap B \)

19) \( A \cup B \)

20) \( A' \)

21) \( B' \)

22) \( (A \cap B)' \)

23) \( (A \cup B)' \)
Examples: Use the Venn Diagram to determine the indicated number of elements.

24) \( n(U) \)

25) \( n(A \cap B) \)

26) \( n(A) \)

27) \( n(B) \)

28) \( n(A \cup B) \)

29) \( n(A') \)

30) \( n(B') \)
31) A survey was given to 100 randomly chosen students which included the following three questions and responses.

<table>
<thead>
<tr>
<th>Do you own a TV?</th>
<th>Do you own a car?</th>
<th>Do you own a TV and a car?</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 said yes</td>
<td>45 said yes</td>
<td>35 said yes</td>
</tr>
</tbody>
</table>

Draw a Venn diagram and answer the following questions:

a) How many students do not own a TV?

b) How many students do not own a car?

c) How many students do not own a car or a TV?

d) How many students own a TV but not a car?

e) How many students own a car but not a TV?

f) How many students own either a TV or a car?